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An Examination of the Paths of Successful Diverse STEM Faculty: Insight for Programming

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Understanding the experiences of successful diverse science, technology, engineering, and math (STEM) faculty can facilitate the development of programming that counteracts barriers and weaknesses from multiple angles. The challenges that students and professionals report can be broadly identified as either identity-based or institutional. The lack of diversity in STEM fields in academia can result in narrow viewpoints, limited student diversity, and missed opportunities to address today's societal challenges. It is clear that we must consider programming that has positively impacted successful STEM faculty in academia in order to create effective programming to recruit and retain future diverse STEM faculty. Our phenomenological study sought to add to the literature related to the role that socialization plays in preparing individuals for success in faculty roles by conducting in-depth interviews with early-career STEM faculty members in under-represented groups. The phenomena under investigation were experiences leading to early-career STEM faculty members' successful career pathways. Seven early-career STEM faculty from multiple institutions described unique paths to their current faculty position with some commonalities, including participation in undergraduate or postdoc research and having some industry experience. The suggestions, advice, and guidance offered by the participants fell into categories that, while mirrored in the literature, serve as useful markers for administrators developing programming. We organized our findings using the conceptual framework of socialization and the associated competencies for our context. As we strive to encourage and build diverse representation in populations of STEM academicians, these collective findings are invaluable. Findings confirm that programming directly impacts the success of early-career STEM faculty, and it is the success of these individuals that will enable diversity and inclusion to expand in STEM. Programs, interventions, and additional efforts for graduate students can also benefit from close examination of these experiences.

Keywords: underrepresented minorities, STEM doctoral students, minority students, early-career faculty success, programming strategies, pathways, experiences

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INTRODUCTION

Benefits of Diversity in Academia

Faculty and researchers from underrepresented minority (URM) groups (i.e., women, African of Americans, Hispanics, Native Americans and Alaskan Natives, and persons with disabilities) continue to be essential to the STEM fields of study. Research continually supports the value of diversity in science, technology, engineering, and math (STEM) research, teaching, and practice as diverse populations bring strong and innovative ideas to complex issues (Committee on Equal Opportunities in Science and Engineering, 2019). Additionally, multiracial faculty members report being more likely to go beyond monoracial definitions of race and ethnicity and utilize more inclusive definitions in their research and classrooms (Harris, 2019). Particularly in academia, underrepresented minority individuals play an essential role in identifying potential blind spots in diversity-based initiatives (Kuchynka et al., 2018). More broadly, programming and a climate supporting underrepresented minorities have been shown to improve job satisfaction for all groups (Smith et al., 2017). In short, when diversity is present in an organization, it creates an upward spiral of successful teams and societies.

Challenges to Diversity in Academia

Even though a diverse workforce is advantageous at multiple levels, underrepresented minority groups have historically been marginalized in the STEM workforce and in higher education (Nelson and Madsen, 2018; National Science Foundation, 2020). While those who are not characterized as being underrepresented as well as underrepresented minority freshmen declare STEM majors at similar levels (37.6 and 34.8%, respectively), attrition disproportionately affects underrepresented minority students and results in only 10% of STEM positions being held by underrepresented minority Ph.D. graduates (Allen-Ramdial and Campbell, 2014). Unfortunately, efforts to increase numbers of STEM faculty and researchers from underrepresented groups within higher education have not resulted in the desired changes (Tanenbaum and Upton, 2014; Blackburn, 2017; Wayne, 2018; Bennett et al., 2020). In some situations, underrepresented minority academicians are simply found in less desirable "contingent" positions than their white male counterparts (Turk-Bicakci et al., 2014). In others, aspiring young, underrepresented minority STEM faculty are attracted to industry with high wages and promises to provide optimum labs and an opportunity to pursue their research without the burden of publishing and grantsmanship success (McGee, 2016; Roach and Sauermann, 2017). Additionally, a crowded and competitive job market narrows the opportunities in academia available to young, underrepresented minority STEM Ph.D. students (Larson et al., 2013) and pushes STEM graduates toward industry and government positions (Xue and Larson, 2015). These reports indicate that barriers must be overcome for underrepresented minority individuals from student to professional levels to contribute powerfully to a diverse STEM workforce.

The challenges that underrepresented minority students and faculty report can be broadly divided into identity-based and institutional challenges and are unique to each population. Underrepresented minority faculty encounter barriers resulting from racial stereotyping (Charleston et al., 2014) and sexism (Kuchynka et al., 2018) both blatantly and subtly (Zambrana et al., 2015). They also report lack of community and networking opportunities (Charleston et al., 2014) in addition to "uneven and idiosyncratic" (p. 199) diversity-related communications on their predominantly white university campuses (Turner et al., 2011). Interpersonal discrimination has been proven to negatively impact STEM faculty's health, stress levels, and academic productivity and performance (O'Brien et al., 2016), and "uncivil treatment drives some women and people of color out of their places of work" (Cortina et al., 2013, p. 1596). Clearly, actively supporting underrepresented minority faculty should remain a priority to reap the benefits of diverse workforces and support equality in higher education.

The Path to Academia

For all students, the path to a STEM career in academia was described as a "longitudinal process" by Ertl et al. (2019). Minority students in STEM face challenges in the continuous pursuit of obtaining success regardless of their decision to pursue faculty positions, including stereotype threat (Steele and Aronson, 1995). These stereotype threats have been extensively studied and require unique solutions for affected persons to overcome (Shapiro and Neuberg, 2007). Allen-Ramdial and Campbell reported that "the greatest barrier to STEM persistence and [entry into the STEM] profession. . .occurs at the undergraduate-graduate interface and reflects the need for a constant upward, opposing intervention force to maintain STEM diversity and persistence" for underrepresented minority students (2014, p. 614). Female students must overcome the stereotype of STEM success requiring intrinsic ability that they may not have (Deiglmayr et al., 2019). Additionally, lower numbers of underrepresented minority students mean that those who are in a department are "hyper visible" (Figueroa and Hurtado, 2013, p. 15) and may feel more isolated, conspicuous, and like they have less room for error (O'Meara et al., 2019). Even when underrepresented minority students are as successful as others in formal learning channels, they may experience disadvantages in informal learning channels, more broadly known as the "hidden curriculum" (Elliot et al., 2016, p. 734). This "hidden curriculum" can significantly affect students' success and refers to the personal, social, and cultural experiences and interactions that faculty, advisors, and peers provide during a doctoral program (Elliot et al., 2016). For instance, persons with disabilities face additional unique challenges both as students (Hartmann, 2019; Jeannis et al., 2020) and professionals post-graduation (Hawley et al., 2014). Finally, global events such as the COVID-19 pandemic affect female students and students of color more negatively than male and white students, respectively; females perceived their learning environment distractions, stress levels, and severity of COVID-19 to be higher (while coping skills were perceived lower) than

males did, and students of color "reported the perceptions of greater risk for their academic future and higher likelihood of reducing or withdrawing from online classes" (p. 5) in addition to a higher perceived severity of infection than white students (Clabaugh et al., 2021).

Strategies to Support Diversity in Academia

All these challenges and more have been reported in the literature. However, efforts to support underrepresented minority graduate students and increase the number who become STEM faculty members have shown some ability to counteract these barriers. Stage and Hubbard (2009) found that institutions lacking in resources available to Ivy League-level institutions were still able to produce numbers of graduates who went on to further degrees in STEM fields. Whittaker and Montgomery (2012) agreed and found, specifically, that Historically Black Colleges and Universities (HBCUs) and Minority Serving Institutions "demonstrated disproportionate success in graduating URM students with STEM degrees" (p. A44) who go on to further their education. Moreira et al. (2019) shared a successful program that supported underrepresented minority students from multiple angles, including mentoring, community building, and professional development. Successfully supporting underrepresented minority STEM graduate students is possible through programs, supports, and interventions that counteract barriers and weaknesses from multiple angles while emphasizing strengths and taking advantage of opportunities. The literature reveals these supports in four broad categories: mentorship and faculty involvement, experiences as future faculty members, campus culture, and academic supports. Regardless of the nature of interventions proposed or undertaken, Tsui (2007) suggests an integrated approach with multiple strategies.

First, support and mentorship from faculty members, especially established or tenured members, is vital to create a strong support system for underrepresented minority graduate students, as noted by Allen-Ramdial and Campbell (2014) and echoed by Casad et al. (2018). Carter-Sowell et al. (2019) added that faculty mentors can serve as both advocates and supports in and outside of an institution with both providing important guidance. Effective mentoring relationships can provide underrepresented minorities in graduate school or early in their faculty career with insights on and connections to departments, senior faculty, or institutions that would fit their desired career path best, but an absence of effective mentoring creates barriers for graduate students and early-career faculty (Zambrana et al., 2015). "Rewarding and maximizing faculty involvement" (Allen-Ramdial and Campbell, 2014, p. 612) adds longevity to positive changes enacted by administration, which can counteract the finding that long-term sustainability is a challenge for programs focused in increasing STEM diversity (Rincon and George-Jackson, 2016). Efforts implemented for underrepresented minority faculty can provide the foundation for similar efforts for underrepresented minority graduate students; institutions can therefore use existing faculty support programs and initiatives as scaffolding for graduate student-focused programs.

Second, hopeful future faculty members should be properly socialized "through many diverse experiences occurring over a time period," with "many different people" involved to provide opportunities to "interact with faculty in ways that help them understand faculty life" (Austin et al., 2009, p. 84). MacLachlan (2006) survey of 33 African American graduate students noted that, if students are to be successful (particularly as faculty members), their graduate education should include training "focused on long-term development after the student leaves graduate school" (p. 7), which is one of the key places where women of color are dropping out of the academic pipeline (Ginther and Kahn, 2012). Additionally, some argue that future faculty members need more opportunities to learn "other responsibilities, such as advising, serving on institutional committees, and engaging in outreach that connects scholarly expertise with societal problems" (Smart, 2006, p. 84).

Third, campus culture can support or undermine underrepresented minority graduate students. Researchers have noted that "student identification with both the institution and science does not happen by chance but is nurtured through some key student experiences" (Hurtado et al., 2011, p. 13) and that a positively perceived school climate improves student achievement (Maxwell et al., 2017). Perna et al. (2009) agreed that structural characteristics of an institution can alleviate the impact of barriers to black women in STEM. Another study of 33 graduate students – 20 of whom served as faculty either immediately or some years after graduation – noted changing jobs to find a "reasonable fit between themselves and their institutions" (MacLachlan, 2006, p. 10), indicating that campus culture is important both for students and after graduation. A culture lacking community but heavy with "individualism and competition" (p. 210) isolates underrepresented minority graduate students and tends to exist in many STEM environments (O'Meara et al., 2019). This isolation, lack of work-life balance, and "feelings of accomplishment and recognition" (Amon, 2017, p. 1) undermine both students' and professionals' success.

Fourth, academic supports have also been shown to empower underrepresented minority students to succeed as long as environmental and cultural barriers are addressed (Whittaker and Montgomery, 2012), and a survey of successful African-American STEM professionals advised that underrepresented minority graduate students should focus on academic success (MacLachlan, 2006). Additionally, inadequate academic preparation can become an issue later in the student's career, when they encounter more challenging courses (Lancaster and Xu, 2017). Academic supports can take the shape of faculty viewing "students as potential scientists who must be fostered and guided" academically instead of "present[ing] a series of tests and trials" resulting in few becoming successful scientists (Stage and Hubbard, 2009, p. 87) or a bridge program or summer orientation (Tsui, 2007; Whittaker and Montgomery, 2012).

Research Related to Experiences of Underrepresented Minority Faculty in Science, Technology, Engineering, and Math

The research on the experiences of underrepresented minority faculty in STEM often emphasizes specific aspects that can impact success. Campos et al. (2021) focus on three areas that require attention: increasing the number of candidates for positions, improving the hiring process, and ultimately providing support once individuals are in positions. Mendez et al. (2021) focus on how the environment impacts the career path of a specific group, Latinx. Wilkins-Yel et al. (2021) focus on women of color and reveals the impact of advisors and personal challenges on these individuals' success. Each study points to areas that need to be addressed by leaders of institutions or practices that have the potential to improve the likelihood of an individual's success. Webb et al. (2022) emphasizes "the need for minority scientists to take an active role in advocating for diversity, engaging mentors, and taking responsibility to face rather than avoid institutional obstacles" (p. 197).

Diversity, equity and inclusion efforts require "deliberate efforts" (Amonoo et al., 2021, p. 4). However, within STEM, the practices employed have not achieved the desired level of diversity sought (Campos et al., 2021). While the academic job market is a fluid environment and the attention to recruitment of diverse faculty changes with time, there is a continuous need to ensure that those who are recruited are able to be successful within the academic setting.

CONCEPTUAL FRAMEWORK

Austin and McDaniels (2006) articulate a summary of "graduate student socialization for faculty roles" (p. 397) in an effort to pull together literature and frameworks to provide a starting point for those interested in building programming to support faculty success. The authors define socialization as "internalizing the expectations, standards, and norms of a given society" (p. 400). Austin and McDaniels (2006) base this definition upon the works of Merton (1957), Merton et al. (1957), Brim (1966), Bullis and Bach (1989), and Weidman et al. (2001). However, Austin and McDaniels (2006) further explain that socialization can be viewed as either a one-way or bi-directional process. As supported by Tierney and Bensimon (1996), socialization within the context of faculty success should encourage both community and individuality, meaning both a learning of the expected norms and retaining one's own uniqueness. Based upon multiple frameworks and literature, Austin and McDaniels (2006) propose four sets of competencies needed for doctoral students who wish to succeed within academia: "(1) conceptual understandings; (2) knowledge and skills in key areas of faculty work; (3) interpersonal skills; and (4) professional attitudes and habits" (p. 417). We believe that organizing our findings into these categories can add to the body of literature.

PURPOSE OF THE PRESENT STUDY

As described, the lack of diversity in the STEM fields in academia can result in narrow viewpoints, limited student diversity, and missed opportunities to address today's societal challenges. Factors that can encourage or discourage success in STEM are myriad, ranging from pragmatic financial constraints to institutional support programs to deeply personal assumptions and perceptions. A summary of these factors is available in **Table 1** and informed this study's interviews. It is evident that we must consider programming that has positively impacted underrepresented minority STEM faculty in academia in order to create effective programming to recruit and retain future underrepresented minority STEM faculty. Our phenomenological study sought to add to the literature by conducting in-depth interviews with early-career underrepresented minority STEM faculty across a variety of institutions to determine elements that enabled their success and provide guidance for programming.

MATERIALS AND METHODS

Our study was phenomenological research as it "describes the common meaning for several individuals of their lived experiences of a concept or a phenomenon" (Creswell and Poth, 2018 p. 75). The phenomena under investigation were experiences leading to early-career faculty success for diverse faculty within STEM. We defined "success" as maintaining a position as a productive faculty member doing some combination of research and teaching at their college or university. We sought to understand the experiences that lead to their current faculty positions so that "practices or policies" (p. 79) could be developed to assist others. Institutional review board approval was received to conduct the study. The research team consisted of individuals with extensive academic experience, diverse backgrounds, and interest in the subject which contributed to the quality of the research. We were specifically interested in the lived experience of early-career underrepresented minority STEM faculty. The following questions guided our research: How did the individuals secure their position? What experiences led to this position? Which experiences contributed and why? What was their journey to their current position and what did it look like?

The selection of individuals to interview was critical as we sought to understand a specific group within a specific context. We were specifically interested in under-represented, diverse faculty members who were early in their career, working within STEM fields. We included agricultural-related departments in our definition of STEM fields. Our definition of diverse faculty followed the National Science Foundation definition which "includes African Americans, Hispanics, American Indians, Alaska Natives, Native Hawaiians, other Pacific Islanders, and individuals reporting more than one race in this definition" (Guenther and Didion, 2014, p. 1). Further, we defined early-career faculty as individuals with 10 years or less of employment in a faculty position. We specifically recruited participants from different types of institutions, recognizing that experiences

TABLE 1 | Summary of factors in the literature that encourage and discourage STEM success in academia for underrepresented minority students.

Encourage success	Discourage success
• Cooperative peer culture (National Academies of Sciences Engineering and Medicine, 2019) • Transportation and housing assistance, healthcare, and food pantries (National Academies of Sciences Engineering and Medicine, 2019) • Faculty mentorship (González, 2006; McGee, 2016; Guy and Boards, 2019; National Academies of Sciences Engineering and Medicine, 2019) • Availability/use of academic supports (intervention for low performers, career guidance, transition to further degrees, peer mentoring) (National Academies of Sciences Engineering and Medicine, 2019) Use of transitional orientation programs (Tsui, 2007) • Availability of research opportunities (Perna et al., 2009; Guy and Boards, 2019; National Academies of Sciences Engineering and Medicine, 2019) • Small class sizes (Perna et al., 2009) • Accessible faculty offices and office hours (National Academies of Sciences Engineering and Medicine, 2019) • "Accountable leadership. . .proactive institutional leaders" who support through their actions (Armstrong and Jovanovic, 2017) • Familial and partner support (González, 2006) • Opportunities to interact with other underrepresented minority students (Petersen et al., 2020) • Strong cultural background/identity (González, 2006) • Programs that develop self-efficacy (Whittaker and Montgomery, 2012) • High numbers of student-faculty interactions (Whittaker and Montgomery, 2012)	• Competitive peer culture (Perna et al., 2009) • Financial challenges (Perna et al., 2009) • Being a "non-traditional" student (commuter, financially independent, transfer student) (Perna et al., 2009) • Small URM populations seen as a "signal to give up" (Armstrong and Jovanovic, 2017) p. 224 • URM women's needs and obstacles being overshadowed by barriers faced by non-URM women (Armstrong and Jovanovic, 2017) • Assumptions and stereotypes (Charleston et al., 2014) • Isolation from peers (Charleston et al., 2014) • Lack of social life due to heavy course load (Charleston et al., 2014) • Racial bias within programs (Figueroa and Hurtado, 2013) • Lack of academic preparation, especially from K-12 education (González, 2006) • Need for newcomers to "establish their validity" (p. S234) to become a full member of their department (McGee, 2016) • Lack of diverse faculty members (Whittaker and Montgomery, 2012) • Search for support interpreted by faculty as inability to succeed in the program (Whittaker and Montgomery, 2012) • Assumption that "minority researchers study minorities" (Guy and Boards, 2019 p. 360)

across different types of institutions offer unique challenges and opportunities and we captured these differences to inform our findings.

Participants were recruited from institutions within a university system in the southern region of the United States. Institutions within the system include Hispanic-serving (HIS), very high research activity (R1), and Historically Black Colleges and Universities (HBCU). The research team worked with administrators and faculty at four system institutions to identify underrepresented minority STEM early-career faculty who successfully obtained faculty positions within the last 10 years, 5–8 years ideally, at the identified system institutions. Each administrator was encouraged to submit two to four faculty members.

Fourteen faculty were invited to participate in the study by an email invitation outlining the scope of the research. The goal to better understand the needs of underrepresented minority graduate students who are preparing for faculty positions was shared with the individuals and they were asked to respond if they would be willing to participate. An information sheet was provided via email that explained the purpose of the study and the expectations should the individual choose to participate. Those who indicated a willingness to participate were scheduled at a day and time convenient for the participant. All interviews were conducted by phone to enable maximum convenience for the participant.

For phenomenological studies, between five and 25 people are suggested for interview by Polkinghorne (1989) and Creswell and Poth (2018) recommend between three to 15 people. Thus, we interviewed seven individuals as we felt we had reached data saturation upon conclusion of the seventh interview. The code numbers of P01 through P07 were immediately assigned to the data to maintain confidentiality. We used the code numbers throughout analysis and when writing the conclusions in order to allow the reader to track individuals across themes.

Credibility was strengthened in the way in which data was collected and analyzed by involving the same two researchers in all interviews; one researcher led the conversation, asking questions provided on the interview protocol and one researcher took detailed notes, asked clarifying questions and then shared those notes with the participant for member-checking.

After the researchers introduced themselves, the participant provided an overview of their area of interest and expanded on their current position. Next, the following guiding questions were used: (a) *Can you describe activities that you participated in that prepared you for your current faculty position, other than traditional coursework?* (b) *Did you visit academic institutions (other than the one you graduated from) during your time as a Ph.D. student?* (c) *What advice can you give us regarding programming that would help underrepresented minority graduate students who are preparing for faculty positions?* (d) *Do you have any suggestions for us regarding how to best assist students?* The interview concluded with follow-up questions to provide clarification about items they had shared.

Interviews were semi-structured allowing participants the opportunity to share comments, suggestions, and provide input outside of the stated original questions. This also allowed each participant to share their journey to their current faculty position. It is important to point out that the interviews were very focused on aspects that influenced the experience of the underrepresented minority faculty. We specifically sought to understand the participants' perspective regarding their experience rather than

merely recording the experience. For example, attendance at a conference was an experience – but it was the actions taken by the individual at the conference that added value to the findings.

It is important to share that we interviewed early career faculty with the intent of understanding how they had obtained and been successful in academia and more specifically within a STEM field. We intentionally wanted to learn from our participants so that we could use what we learned to improve mechanisms we were currently putting in place to assist underrepresented minority doctoral students and those moving into early careers in academia. One of the questions in our protocol related to their recommendations based on their own experience. Thus, our participants' experiences as a graduate and undergraduate student were relevant to the purpose of the research.

"Conversational mode" (Yin, 2016, p. 143) was used to allow the researchers to avoid directing the participants toward a particular response. The individuals being interviewed were extremely willing to share what they had learned from their experiences, which experiences had benefited them the most, and how the journey to their current position took place.

Key elements from the literature (**Table 1**) were not mentioned until the end of the interview at which time the researchers sought to clarify any items from the perspective of the participant. At the conclusion of the interview, participants were asked if they would be willing to share a copy of their vita with the research team.

Immediately following the conclusion of the interview, the note-taking researcher finalized the notes and shared them with the second researcher for review and confirmation of what was documented. The two researchers also debriefed to ensure that the notes reflected what had been shared. These notes were then sent to the participant for confirmation and to allow the participant to correct any misunderstandings. This member-checking allowed us to have confidence in our data as the session was purposefully not recorded out of respect for the participants. As noted by Lincoln and Guba (1985), "advantages [of recording] are, in our judgment, more than offset by respondent distrust" (p. 272). Six of the seven participants participated in member-checking by reviewing the notes and providing edits. Participant P06 did not respond to the request to provide feedback on the notes. Interviews lasted approximately 57 min each and yielded an average of four pages of single-spaced notes (2,390 words) per interview.

Data analysis consisted of initial review by the researchers beginning with inductive open coding following a four-step process. We looked at "what" (Creswell and Poth, 2018, p. 77) the individuals experienced and "how" (Creswell and Poth, 2018, p. 77) they experienced it as we sought the "essence" (Creswell and Poth, 2018, p. 77) of what led to their successful attainment of a faculty position. We then triangulated this with the literature. Care was taken "to avoid imposing external criteria or categories prematurely on the real-world conditions being studied" (Yin, 2016, p. 83). The initial review started with our review of the data as a whole, looking for overall themes and noteworthy statements. These statements were compared with one another and with the literature. Those that matched literature were grouped accordingly. Second, we grouped the statements into themes to represent "clusters of meaning" (Creswell and Poth, 2018, p. 79). This was accomplished using the constant-comparative method in which each set of notes was read and as a theme emerged it was recorded and color-coded. The listing of themes which emerged from the first review was used as the starting point for the second review and so forth until a final list of themes was reached. The complete listing of themes was then reviewed by two additional researchers to ensure accurate representation of participant ideas. Third, we sought to determine how "the context or setting influenced how participants experienced the phenomenon" (Creswell and Poth, 2018, p. 80) by looking at examples and context provided by the participants. Finally, we developed a "composite description" (Creswell and Poth, 2018, p. 80) where we articulated a summary of common experiences across participants related to the phenomenon.

Trustworthiness relates to the degree to which a reader can trust that the methods used to collect the data as well as the data themselves are valid and reliable. We established trustworthiness by documenting the exact procedures used to collect the data, conducting member-checks, and triangulating our findings. Triangulation was accomplished by looking for "converging lines of inquiry" (Yin, 2016, p. 87) throughout the data collection process. The same two researchers participated in all seven interviews and debriefed following each session. This enabled immediate sharing of impressions and understandings. This was followed by a review of the detailed notes to enable edits and corrections from both the second researcher and the participant (i.e., member-checking). Maxwell (2013) provides strategies to combat threats to validity within qualitative research. Of those strategies, we employed four of them: "rich data," "respondent validation," "triangulation," and "comparison" (pp. 126–129). The notes taken during the interviews were extremely detailed resulting in rich data. Six of the seven participants provided feedback regarding their associated notes. The data was compared and triangulated with the literature (Yin, 2016).

We ultimately interviewed four female and three male participants who had been in their faculty position for an average of 4.8 years (range from 1 to 9 years). These participants represented three institution types as defined by The Carnegie Classification of Institutions of Higher Education (2021): Hispanic-Serving Institutions ($n = 3$), R1 ($n = 2$), and Historically Black Colleges and Universities ($n = 2$). Undoubtedly, they had different experiences that reflect the diversity of their backgrounds as is noted in **Table 2**. Participants included three African-American and four Hispanic individuals.

RESULTS

Participants' Backgrounds

Of the seven (four female and three male) faculty members interviewed, six were assistant professors and one was an associate professor; they had spent an average of 4.86 years in their position with a range of 1–10 years. Faculty were from science departments (i.e., geology, chemistry, biology, and engineering) or agriculture-related departments (i.e., agronomy, agricultural and biological engineering). Three currently work at Hispanic-Serving Institutions, two work at an R1 Institution,

TABLE 2 | Individual journeys: Descriptions of each path to a faculty position.

Code	Description of journey
P01	Path: BS > Ph.D. > Faculty position ■ Involved in undergraduate research ■ Completed internships in industry ■ Encouraged by a graduate student to apply to graduate school ■ Conference attendance during graduate school was important ■ Visits to universities during graduate school were important ■ Completed NSF fellowship ■ Not able to secure post-doc – would have liked to
P02	Path: BS > MS > Ph.D. > Center work > Faculty position ■ Involved in undergraduate research ■ Doctorate at international university ■ Conference attendance during graduate school was important ■ Worked at a research center while pursuing PHD ■ Worked in research center after PHD for 6 years before securing faculty job (compared it to a postdoc)
P03	Path: BS > MS > Ph.D. > Postdoc > Industry > Faculty position ■ Involved in undergraduate research ■ Attendance at conferences during graduate school was important ■ Visits to universities were important ■ Worked in industry for 2–3 years before academia
P04	Path: BS > Medical school (2 years) > Ph.D. > Postdoc > Faculty position ■ Involved in undergraduate research ■ 2 years medical school before PHD ■ NIH-RISE fellowship ■ Attendance at conferences during graduate school was important ■ Adjunct at university while a postdoc
P05	Path: BS > MS > Ph.D. > Postdoc > Faculty position ■ Involved in undergraduate (UG) research ■ Worked in a national lab while UG ■ Graduate student encouraged me when I was an undergraduate student. ■ Strongly recruited by institution (original plan was law school) ■ Participated in targeted programming ■ Attendance at conferences during graduate school was important
P06	Path: BS > MS > Center work > Family emergency > Ph.D. > Adjunct faculty > Industry > Postdoc > Staff position > Faculty position ■ Involved in undergraduate research ■ Worked at a national research center (Lab manager) ■ Alfred sloan scholarship, a USDA national needs scholarship
P07	Path: BS > Industry > MS > Industry > Ph.D. > Postdoc > Faculty position ■ Doctorate at international university ■ Attendance at conferences during graduate school was important ■ Participated in European educational approach: research/publishing instead of traditional courses

and two work at a HBCU Institution. Most (n = 5) had some type of industry experience prior to their current faculty position: as interns (P01), researchers (P03, P05, P06), or other types of work (P07). Two had little to no industry experience. In their current faculty positions, four have a strong focus on research (P01, P02, P06, P07), two focus equally on research and teaching (P03, P05), and only one has a stronger focus on teaching than research (P04).

Journey Descriptions

Each of the participants described unique pathways to their current faculty position with some commonalities. Four of the participants (P01, P03, P05, P06) completed their doctoral degree at a 4-year R1 domestic institution while three of the participants (P02, P04, P07) completed their doctoral degree at an international institution. It is common for students to accumulate some debt while attending a college or university. This debt can cause financial challenges (P01, P02, P03, P04, P06, P07) which can cause "students [to]go to industry" rather than moving onto a graduate degree simply because "they have too much debt" (P07). The majority of our participants had engaged in undergraduate research (P01, P02, P03, P04, P06) and/or a postdoc experience (P03, P04, P05, P06, P07) prior to their faculty appointment, completed a Masters degree before starting their Ph.D. (P02, P03, P06, P07), and had at least some experience with industry (P01, P03, P05, P06, P07). While each had successfully secured a faculty position, some had direct interest in academia with little interest in industry (P01, P03, P04, P07) while others had not planned on entering academia (P02, P05, P06). **Table 2** provides a detailed summary of each path shared that resulted in the participant securing a faculty position.

Elements Impacting Success

Regardless of the path taken to obtain a faculty position, data analysis revealed several common themes expressed as important to their success that included: preparation for

research, conference attendance, networking, preparation for teaching, visits to institutions, role of mentorship, and soft skill development. In addition, topics of bias, financial challenges, and individual attributes were shared. Each of these themes point to marginalized professional visibility, networking challenges, resilience and independence, skill acquisition, and understanding the hidden curriculum. These themes are presented below according to Austin and McDaniels (2006) published framework.

Conceptual Understandings

Austin and McDaniels (2006) note four major components of conceptual understanding. Of these, participant interviews supported three: "understanding of the types of higher education institutions and their missions," "understanding of one's professional identity as a professor and scholar," and "knowledge of the discipline" (p. 418).

While not all participants took part in formal institutional visits, many of them revealed that these visits could be extremely impactful if coordinated and executed in effective ways. The importance of presenting/teaching at the institution (P01, P05, P06), meeting with colleagues/administration (P01, P05), and gaining an understanding of diverse cultures and approaches (P05) was highly valued as this can encourage future collaborations (P02). One participant noted that being exposed to and understanding differences between institution types can be a marketable characteristic as one will be able to use that experience to create their own programs at new institutions (P07). One participant recommended that "STEM students need to think about all the different academic institutions that exist. . .and understand the differences so that they can see what these academic positions would look like" (P01). Similarly, another mentioned that "there is a need for awareness of the paths – it may not be a direct path [to a faculty position]" (P03).

Forming a professional identity heavily relies on socialization and mentorship for aspiring faculty members (Austin and McDaniels, 2006). For our interview participants, socialization came from peers (P01, P02), faculty members (P01, P02, P03, P04, P05, P06), and events like workshops and seminars (P02, P03, P04, P05). One participant (P03) summarized the value of mentorship for graduate students considering faculty positions by stating, "just having the examples of faculty like myself would be valuable for those making a decision" (P05). Elements of mentorship were communicated as having a direct impact on professional identify. As noted by participants, "Finding the right mentor is very important" (P04), "Students need to talk to people to understand expectations [for faculty]" (P01). As stated, "I had no way to navigate the academic waters. . .[mentorship] set me on the awesome path that I have been blessed to be on." "[My mentor] was like the bumpers in bowling, he would get me re-aligned" (P06). Similar to mentorship, conference attendance was also indicated as influencing professional identity: "A part of [conference attendance] is that you see a lot of professors at these meetings. You hear about the research and have respect for them, and you want to be a professor yourself" (P02). Additionally, the feelings of imposter syndrome are a reality for many. Students need to learn to engage in self-promotion (P01) and embrace "hard work and determination" (P03) to help address impostor syndrome (P05) feelings. One participant described they "definitely felt imposter syndrome" and "felt isolated," but once it was recognized they further explained that "I cannot let this impact me. . . even though my question might feel like a dumb question – it is ok to ask" (P05).

Professional identity is directly connected with discipline knowledge. Multiple participants indicated that individuals must have confidence in their knowledge, skills and abilities (P03, P05, P06, P07).

Knowledge and Skills in Areas of Faculty Work

Austin and McDaniels (2006) articulate that faculty work includes "teaching, research, public service, and institutional citizenship" (p. 422). Interviews revealed that our participants strongly agreed with the importance of understanding teaching, research, and service but did not emphasize institutional citizenship.

All participants expressed the value of being prepared to teach – even those in a research-focused position. Participants indicated that this preparation made one more marketable to hiring committees. As one stated, this "allowed me to be an adjunct" and teach (P04). Teaching experience was described as making a person "well rounded" (P02) and providing a skillset important to succeed as a faculty member (P01). This was demonstrated as one participant described that as a mentor, "You have to help them see how to be an effective teacher early so that they can do well at teaching and enjoy the process – or they will be turned off teaching. . .in science we are not always trained to be teachers" (P01). As one participant stated, "I did all my teaching prep outside of normal work hours" (P07), indicating that more teaching preparation would have been valuable. Teaching preparation included serving as a teaching assistant (P01, P04, P06) and creating their own opportunities to gain these skills (P03, P05). The importance related to understanding the mentality of students (P06), being able to create activities (P06), understanding course development (P01, P05), and being an effective teacher (P01). It was shared that not having this experience could negatively impact success in a faculty role regardless of the position's effort distribution.

Given that our study focused on early-career underrepresented minority faculty in STEM, we were not surprised that comments related to research were mentioned. In fact, for graduate students in STEM fields, research is an integral part of the degree. In their doctoral program, P07 noted that "your Ph.D. is validated by your publications, where you publish, the quality of your work."

Participants expressed that "A positive and supportive student culture is important and interaction among students is critical" (P01) especially in regard to research. They further shared that "Being able to be confident to do research as an undergraduate will provide you the experience so that by the time you go into a Ph.D. program – you are a co-author – you have the experience of learning how to present your research" (P02). The connection to undergraduate experiences was strongly

supported, "I participated in undergraduate research – this got me hired at NASA – because of my work" (P06). The importance of research preparation was emphasized by the statement, "I think students waste a lot of time taking classes instead of doing research" (P07). It is important to note that these individuals also specifically mentioned grant identification and grant writing (P01, P02, P03) as elements needed for programming. It was notable, as mentioned earlier, that undergraduate research (P01, P03, P04, P05, P06) appears to have played a significant role in their path to a faculty position. The importance of gaining confidence in one's own research (P02) and the overall research experience (P06) were noted as critical.

While not mentioned as frequently, service was addressed by our participants. P01 acknowledged that service was one of the three items aspiring faculty are "graded on," sharing an example of how aspiring faculty "need to learn how to develop a broader impact program from the very beginning, [such as] working with high school students – these are not taught within Ph.D. programs." Others mentioned their service involvements such as leading study abroad (P04), advising student organizations (P04, P06), and supporting student conferences (P05). P06 mentioned leaving a position because "I did not feel like I was making an impact" (in reference to public service). This participant (P06) reported finding their niche in a postdoc position that was strongly service-based.

Interpersonal Skills

Interpersonal skills are described as supporting faculty work (Austin and McDaniels, 2006). These can include communication, teamwork, collaboration, and recognizing the importance of diversity. In our present study, the development of these soft skills was expressed as an important area of consideration. A participant with industry experience stated, "The biggest thing that helps you survive in industry is the soft skills – that was my biggest take away. . .soft skills and working well with people helps you keep those jobs" (P03). As shared by P05, the ability to interact with people is important.

Specific to communication, presentation skills (P01, P04), writing skills (P01, P04, P06), problem-solving skills (P06), and the ability to work with different populations (P01) were each mentioned. "Workshops on how to present are needed" and "students should attend writing workshops" (P03). "You can be very smart but. . .not be mentally prepared to handle politics. . .and that may make you say the wrong things and put people off, so being aware is important" (P03). Several shared that submitting to and attending conferences (P01, P02, P03), writing grants (P01, P02, P03), and visiting other academic institutions (P01) was a valuable way to practice such skills. As noted by a participant, presentation skills can have considerable impact. "If a person is declined for a tenure track position, they need to think about how they presented to the search committee" (P01). As noted by P02, "When we interview people, a lot of the things they are looking for is someone who has experience with grant writing and publications."

Austin and McDaniels (2006) note that time management is also important in this section, and participants mentioned this as a particularly important research skill. "Without my experiences as a research scientist – it would have been very tough – managing your time can be a challenge" (P03), in reference to serving as a faculty member. Participants did not explicitly mention teamwork or collaboration skills but they did refer to these skills indirectly. As stated by one participant, being a faculty member means that work is done in "a true interdisciplinary environment. . .in academia we touch everything" (P06).

Working and interacting with diverse groups was stated as important for our participant group. As stated in one interview, "early career faculty need this exposure [to new environments]" (P01). Another mentioned that they "had opportunities to sit on boards as a graduate representative. . .it was a great and wonderful experience, I had colleagues in other disciplines with other experiences" (P05).

Several of the participants indicated that they had experienced bias (P01, P02, P07). Unfortunately, one of the participants experienced racial bias and stated that "A visiting professor assumed I was from another country and told me that I speak well for being from Mexico. . .I am a fifth generation American, and English is my native language. It was blatant racial bias" (P01).

Professional Attitudes and Habits

Austin and McDaniels (2006) describe professional attitudes and habits as including "ethics and integrity" (p. 428), "motivation for lifelong learning" (p. 429), "cultivating professional networks" (p. 430), and "nurturing one's passion while maintaining balance in life" (p. 430). Participant interviews revealed strong support for lifelong learning, cultivating professional networks, and passion and life balance but did not discuss ethics and integrity.

Although pursuing lifelong learning was not specifically mentioned by participants, the aspect of keeping a flexible career mindset was frequently noted as a valuable skill. "These days in the applied sciences, it is difficult to go straight into faculty. . .it is good to prepare the minds of students to be flexible with how these things go" (P03). Similarly, P06 noted that "my journey to get a Ph.D. was not a planned process. . .my path was haphazard", and P05 shared that "industry was my first choice." P03 recommended that programs "prepare students for both industry and academia, otherwise they don't have the tools for one or the other – they need to be prepared to step into both roles."

Participants constantly referred to networking as crucial to their success, as the importance of general networking was mentioned specifically by all but one participant (P01, P02, P04, P05, P06, P07). One participant noted that this activity takes time and effort, saying "If it was not for the networking I did I would not be where I am. . . real networking does not start at a poster, that is not enough" (P04). Furthermore, having "a positive and supportive student culture is important and interaction among students is critical" (P01). However, as shared by P02, "students need guidance on networking". This "guidance" for networking skills was expressed by multiple participants. One individual stated, "I squandered so many opportunities to make connections because I did not know how and did not recognize the importance [of networking]" (P06). They went on to state, "Coming from the socio-economic [background] that I came from – I did not know what networking meant" (P06).

Mentorship is closely related to networking as mentors often introduce their mentees to networks and provide tips for navigating relationships and careers. Similar to networking in general, mentoring was expressed as a key contributor to success throughout the path to a faculty position (P01, P02, P03, P04, P06, P07). "A mentor needs to give you encouragement and stability – to help you when things are not going well – the role of that person is to guide you and tell you it is ok and help you be resilient" (P03). This illustrates why "finding the right mentor is important" (P04) and that "the mentor will promote their students and introduce them to others: it is about helping them develop relationships" (P07). One of the challenges with mentorship was matching mentors to students. "When [a mentor] is assigned to you it is not as beneficial – it needs to be organic" (P01).

One major opportunity for networking is conference attendance, and both domestic and international conferences were indicated as important (P02, P04, P05). All participants emphasized the importance of conference attendance for networking and success (P01-P07). As one individual stated, "this is where we meet the people who we would end up working with" (P04). Specific reasons for importance included the opportunity to connect with other students (P01, P02), the opportunity to experience presenting (P02, P03, P06), connecting with future colleagues (P02), networking (P07), and overall exposure (P07). As one participant stated, "my professors guided me to attend the conferences. . . I did not realize how valuable it was" (P06). Participants indicated that attendance did not need to be formal (P01). As shared by one participant, "Attendance at conferences in groups is better because it allowed us to share – some people are natural in introducing themselves but overall, it is hard to interact with people – going as a group helps" (P02).

In the next category, participants (P01, P04, P05, P07) noted their passion for and enjoyment in their positions: "the beauty of seeing a student understand a concept, there is nothing better than that" (P04), "[being a faculty member] is the best job in the world" (P05), and "in academia, I have freedom" (P07). Work-life balance was seen as a benefit of faculty positions compared to industry positions (P04, P06). However, having a passion for work can be difficult for some because "there are no positions that I am specifically qualified for, it is stiff competition" (P01).

While the topic of "ethics and integrity" as noted by Austin and McDaniels (2006, p. 418) was not addressed by our participants, they did address the concept of hard work. As noted by one, "students need coping skills and resiliency" (P01) to be successful in faculty positions.

DISCUSSION

Connection to Conceptual Framework

Our findings support the framework of skills and abilities articulated by Austin and McDaniels (2006) that can be obtained through choreographed socialization within the academic context. Participants expressed specific items that are reflected in each of the four categories: "(1) conceptual understandings; (2) knowledge and skills in key areas of faculty work; (3) interpersonal skills; and (4) professional attitudes and habits" (p. 417).

While our participants provided direct statements that support several aspects reflected in "conceptual understandings" (Austin and McDaniels, 2006, p. 417), it is important to note that participants did not overtly mention items that relate to consideration of the history and purpose of higher education or specific reference to knowledge of one's discipline. We believe that knowledge of one's discipline may be seen as a given and that is why participants did not mention it. Regarding history and purpose of higher education overall, we believe this is an area that may need to be considered in programming as it does not appear our participants received training in this area. As noted by Austin and McDaniels (2006), understanding of history and purpose can enable understanding of culture, norms and expectation which then impacts socialization.

"Knowledge and skills in areas of faculty work" (p. 422) was directly addressed by our participants regarding teaching, research, and service. However, institutional citizenship was not directly mentioned. Perhaps this is due to our research focus and line of questioning. This could also be a result of our target population which was early-career faculty. Engagement in institutional governance and modeling such behavior may be more prevalent in faculty further along in their careers. Regardless, this topic may be worthy of future study.

"Interpersonal skills" (p. 427) in relation to communication skills, collaboration and teamwork were addressed by our participants. However, the concept of "appreciation of diversity" (p. 418) was not directly addressed in the way noted by Austin and McDaniels (2006). Instead, this topic was touched upon through conversations about bias and lack of inclusion. This is likely due to our focus on diverse faculty who were looking at it from a different angle. They experienced what happens when diversity is not emphasized and rewarded. This is a culture shift in departments.

Concepts within the area of "professional attitudes and habits" (Austin and McDaniels, 2006, p. 428) were indicated by participants to be obtained primarily through networking, mentorship and attendance at conferences. This engagement with successful peers through these mechanisms encouraged awareness of the culture of their field and provided serendipitous opportunities that impacted each participant's career path. It is likely that the reason "ethics and integrity" (Austin and McDaniels, 2006, p. 418) did not emerge in our interviews was due to our line of questions. However, that area might be worthy of further study.

Impactful Experiences

As we strive to build programming to support underrepresented minority STEM graduate students to secure faculty positions in academia, the impactful experiences illuminated in the paths illustrated in our study are worthy of consideration. Each of the following experiences directly impacted success: undergraduate research engagement, postdoc positions, and working in centers/labs/industry. As noted in previous research (Perna et al., 2009; Guy and Boards, 2019;

National Academies of Sciences Engineering and Medicine, 2019), we found that undergraduate research experience played a role for five out of seven of those interviewed. Not surprising, but notable, is the role that postdoc positions played in the success of the majority of those interviewed. Further, participants shared specific input regarding ways to support students including preparation for research, conference attendance, networking, preparation for teaching, visits to institutions, role of mentorship, and soft skill development.

Undergraduate Research Experience

Given that the majority of our participants expressed value in the undergraduate research experience, we recommend that programming target undergraduate students in STEM as a recruitment tool to increase the diversity of graduate students and faculty. Previous research has identified that students who participated in undergraduate research have better research skills as STEM graduate students (Gilmore et al., 2016). This experience is essential in building a sense of self-efficacy and interest in STEM research, which then encourages the continuing success through the academic pipeline. Based upon our data, it appears to be carried over into their performance toward the completion of a STEM graduate degree and ultimately contributed to these participants' successful careers as STEM faculty.

Role of Postdoc Positions

Postdoctoral positions are integral for both the training of Ph.D. graduates and improving the research productivity of faculty members. For the participants in this study, involvement in postdocs allowed more time within academia, which may have provided them with additional scholarly training and mentorship to advance in the professoriate. Though all participants did not obtain postdocs (e.g., P01), most participants had post-doctoral or equivalent positions. These positions are often limited in duration, minimally represented in departments, and their roles within departments may be ill-defined (van der Weijden et al., 2016; Hudson et al., 2018).

There are some interesting demographic trends within certain STEM fields. For instance, within biotechnology in the United States, those who are temporary residents or Asian are more likely to take on a postdoc position than White and other ethnic minorities (Kahn and Ginther, 2017). This finding is mirrored in the more extensive National Postdoc Survey, where non-United States citizens are more likely to opt for an academic position than citizens (McConnell et al., 2018). However, this survey also highlights White or those not in the category of underrepresented minorities hold the majority of postdocs. Future research should ascertain why these positions do not attract more United States citizens who are underrepresented minorities, given the value of postdocs to our study participants in their pathway to academia. These findings also speak to a general lack of research on experiences of underrepresented minority postdocs within the United States.

There is also a possibility that postdoc positions are attractive to those who are interested in academic positions with more emphasis on research than teaching. Some studies highlight this possibility in their findings; STEM academics with undergraduate research experience and research assistantships are more likely to pursue postdocs than those who do not have such experiences (Kahn and Ginther, 2017; Martinez et al., 2018). Given that faculty positions require equal or more investment in teaching, those passionate about research may opt to spend more time in research-focused positions in academia before transitioning to a faculty position. However, because postdoc positions are undervalued in distinct ways (e.g., a backup option for those who did not receive tenure-track positions), the importance of postdocs in the development of those interested in research may be overlooked. The inclusion of postdoctoral scholars within the scope of programming is important as it can provide an avenue to elucidate the barriers to getting and moving on from postdocs.

Programming Recommendations

The suggestions, advice and guidance provided by these successful early-career faculty fell into categories that mirrored those found in the literature. Socialization in the context of academia and faculty positions and the associated competencies (Austin and McDaniels, 2006) can directly impact an individual's success. Further, results of our study support literature shared in **Table 1** which articulates factors that can encourage and discourage success.

Research opportunities, as noted in our study and the literature (Perna et al., 2009; Guy and Boards, 2019; National Academies of Sciences Engineering and Medicine, 2019), are critical and an integral part of the STEM environment. Grant writing is a critical part of the research process and should be addressed through programming. Further, to perform well in the academic teaching environment, we recommend complimenting those opportunities with opportunities to develop teaching skills so that individuals enter a faculty position with knowledge and skills to engage in teaching without additional burden. All our participants expressed the need for training in teaching so that teaching activities would not distract from or slow their research. This is supported by Austin and McDaniels (2006).

Interpersonal relationships can result in networks which can be formed through mentorship, conference attendance and visits to institutions. While each of these areas emerged as separate themes within our data, it is important to recognize the interplay among them. Networking was emphasized by six of the participants. As we consider networking, it is critical to consider not only providing networking opportunities but also guidance on how to network, protocols to network effectively, and awareness of how individual actions can impact future opportunities. Mentorship, as noted in the literature (González, 2006; McGee, 2016; Guy and Boards, 2019; National Academies of Sciences Engineering and Medicine, 2019), is critical but must be approached carefully to be successful. As noted in our study, successful mentorship requires an organic element. Conference attendance and visits to institutions can directly expand one's network; however, if not approached with purpose there can be missed opportunities. These areas deserve increased attention; our participants indicated the importance of attendance at professional conferences with reasons including networking, presentation practice, and connections. Many participants expressed that they were not fully prepared to take

advantage of the opportunities in these situations. The area of soft skill development is an overlooked area within STEM. The ability to communicate one's ideas in a way that is received positively, overcome stereotypes and misinterpretations, and successfully express confidence in one's ideas requires inner strength and fortitude. We must continue to create programming that will instill these attributes. The incorporation of soft skill development into the undergraduate research experience may be one way to address this need. Austin and McDaniels (2006) does not specify how interpersonal skills should be obtained but their framework does support the development of these skills.

While the purpose of our study was not one of recruitment into STEM, it is interesting that one of the participants had originally pursued medicine and one law prior to entering a STEM faculty position. These individuals expressed that once they were exposed to STEM and the potential pathway, they could see how they fit within STEM. Therefore, we need to find ways to show students possibilities. These findings are in line with empirical work showing that early engagement in activities related to STEM (e.g., informal learning of science and math) promotes interest in and motivation to pursue STEM (Master et al., 2017; Goff et al., 2020).

LIMITATIONS

We conducted this study prior to the pandemic (i.e., COVID-19) and several nationwide instances of racial bias and social injustices occurring in 2020. It is important to note that these events resulted in a renewed focus on the need to address diversity issues. The individuals interviewed for this study may not have had the same experiences or experienced the same environment as today's aspiring faculty members. Although our findings supporting the value of certain experiences is still valid, additional research to describe the current environment is needed.

DATA AVAILABILITY STATEMENT

The datasets presented in this article are not readily available because participants of this study did not agree for their data to be shared publicly, so supporting data is not available. Inquires about datasets should be directed to TM.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Texas A&M University, TAMU 1186, College Station, TX 77843 (https://vpr.tamu.edu/human-research-protection-program/). Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

KB-P and ER contributed to financial backing and initial project funding acquisition for the overall project. TM and CC conducted the data collection activities that included interview scheduling, interview conducting, and note-taking. TM, CC, and AR analyzed data that included interview notes and curriculum vitae of participants. TM, AR, AG, and AC-S contributed substantially to initial manuscript writing. KB-P, LC, ER, and AG contributed substantially to the manuscript editing. KB-P, ER, and AC-S critically revised this work for important contextual topics. All authors contributed to the article and approved the submitted version.

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